



A new species of *Candidula* (Gastropoda, Hygromiidae) from central Portugal

Una nueva especie de *Candidula* (Gastropoda, Hygromiidae) de Portugal

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ABSTRACT

A new species *Candidula coudensis* is described from Vale da Couda (Almoester, Leiria), in central Portugal. It differs from other species of the genus in combining a large shell with sharp peripheral keel and coarse radial ribs with a penis bearing a long flagellum. The new species lives together with *Candidula* cf. *belemensis* (Servain, 1880) on rocky limestone slopes.

RESUMEN

Se describe la nueva especie *Candidula coudensis* del Vale da Couda (Almoester, Leiria), en la región central de Portugal. Difiere de otras especies del género por presentar una concha grande con fuerte quilla carenal y gruesas costillas radiales, y un pene provisto de un largo flagelo. La nueva especie vive junto con *Candidula* cf. *belemensis* (Servain, 1880) en pendientes calcáreas rocosas.

INTRODUCTION

During fieldwork in the limestone hills above Vale da Couda (district of Leiria, formerly Beira Litoral), central Portugal on 31st January 2008 an unfamiliar "helicellid" (Hygromiidae) was found. Because of its light-coloured, sharply keeled shell with strong radial ribs it was initially thought to be *Candidula setubalensis* (L. Pfeiffer, 1850), known only as an endemic of the Serra da Arrábida near Setúbal (district of Setúbal, Portugal). Subsequent studies

have revealed that the genital anatomy of the snail from Vale da Couda is typical of *Candidula* in having only a single large dart sac as in *C. setubalensis* (GITTENBERGER, 1985) but it differs from that species in the much longer flagellum on its penis. Since the shells of *C. setubalensis* also differ in several characters from those of the snail from Vale da Couda the latter is described here as a new species. A fuller review of the species of *Candidula* in Portugal is in preparation.

TAXONOMIC PART

Family HYGROMIIDAE Tryon, 1866
Subfamily HYGROMIINAE Tryon, 1866
Tribe Helicellini Ihering, 1909

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Genus *Candidula* Kobelt, 1871

Type species (by absolute tautonymy): *Helix candidula* Studer, 1818 = *Candidula unifasciata* (Poirot, 1801).

Remarks: Allocation of the genus *Candidula* to the Tribe Helicellini in the Hygromiidae follows BANK, BOUCHET, FALKNER, GITTENBERGER, HAUSDORF,

PROSCHWITZ AND RIPKEN (2001), BANK, GROH AND RIPKEN (2002) and FALKNER, BANK AND PROSCHWITZ (2001).

Candidula coudensis spec. nov. (Figs. 1-7)

Type locality: Vale da Couda, by N348 road SE. of Almoester (district of Leiria, Portugal), 29S NE498099, ca 390 m alt., herb-rich grassland and low shrubs by road.

Type material: Holotype (Figs 1-5; in the BM, reg. no. 20100177) from type-locality collected 12 Dec. 2009, leg. G.A. Holyoak; body in spirit and dry shell kept separately (holotype and several paratypes kept alive until 16 Jan. 2010).

Paratypes: 4 dry shells (BM, reg. no. 20100178) and 4 in spirit (3 shell and body, 1 body only, BM, reg. no. 20100179), 57 dry shells, 2 shells containing bodies kept in spirit and 5 bodies in spirit with dry shells kept separately (Collection of G.A. Holyoak). Additional paratypes from near type-locality, all in Collection of G.A. Holyoak: 10 shells, 1 body in spirit (used for Figs. 6, 7) and dry shell kept separately, collected 31 Jan. 2008 (limestone crags and slopes, 29S NE498099); 31 shells, 1 body in spirit and dry shell kept separately, collected 10 June 2009 (low limestone crags and slopes, 29S NE498099); 44 shells, collected 12 Dec. 2009 (scrub-covered limestone hillside with low walls and scree, 29S NE497096).

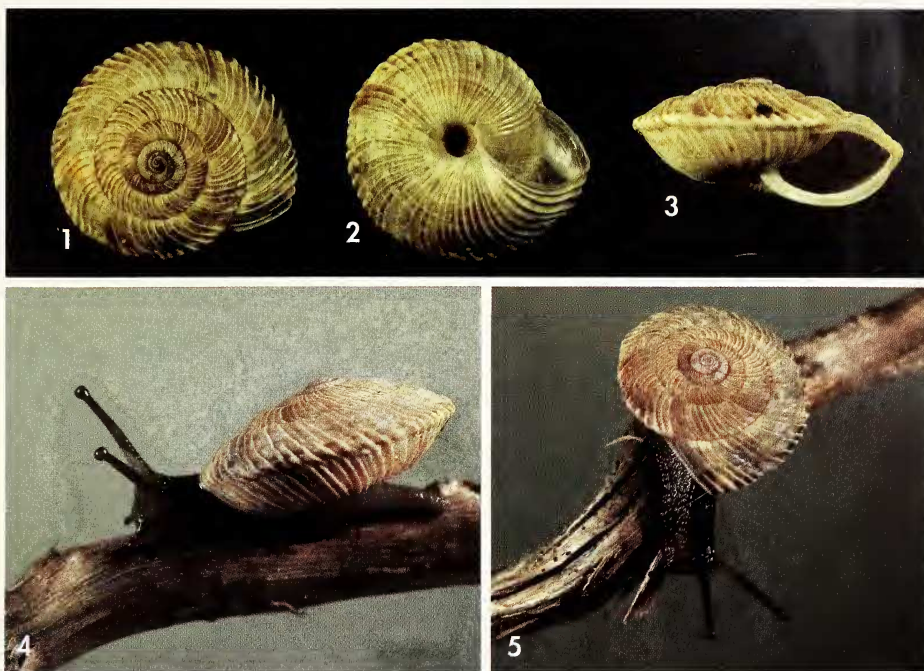
Etymology: The specific epithet *coudensis* is an adjective derived from the name of the type-locality at Vale da Couda. The generic name *Candidula* has been created as a feminine noun, so the termination of the epithet *coudensis* is therefore feminine in agreement.

Description: Adult shell (Figs. 1-3) dextral, strongly compressed above, with low convex to low-conical spire of 5¼-5½ flattened whorls with shallow sutures and sharp slightly raised keel at periphery. Umbilicus $\frac{1}{5}$ - $\frac{1}{7}$ width of shell, symmetrical, exposing parts of several whorls of spire internally, open or slightly overlapped by peristome. Mouth slightly oblique, oval but somewhat flattened above and below with prominent keel at periphery, thin peristome and white internal rib. Shell opaque, pale cream to light brown (fading to whitish) with very variable broad to narrow bands of dull brown to blackish-brown that are variously distinct, fused, blotched or interrupted, sometimes almost lacking on underside of shell. Shell surface not or slightly glossy, with radial ribs which are pale on top; on lower whorls ribs become strong, evenly spaced, with each rib conspicuously raised and thickened at the peripheral keel; on underside of

shell the ribs reach the umbilicus, within which they are reduced to rows of papillae; microsculpture of fine spiral parallel grooves is often present on body whorl, especially on underside. The protoconch appears smooth at $\times 30$ magnification; there is no trace of hairs or hair-pits on the upper whorls.

Exposed parts of body of living animal (Figs. 4, 5) light to rather dark grey, with some brown suffusion and blackish foot fringe. In detail, the skin tubercles are variably suffused with brown and outlined in dark grey.

Genital anatomy (Figs. 6, 7); description based on dissection of four individuals; "proximal" and "distal" in the following account refer to the position in relation to the genital orifice. The right ommatophore retractor muscle runs free, i.e. it does not cross between penis and vagina. Flagellum long (longer than epiphallus), slender, tapering, curved; epiphallus slightly shorter than penis; penial retractor muscle attached to prox-



Figures 1-5. *Candidula coudensis* spec. nov. holotype, shell 11.6 mm in width (BM reg. no. 20100177). 1-3: adult shell; 4, 5: holotype photographed alive.

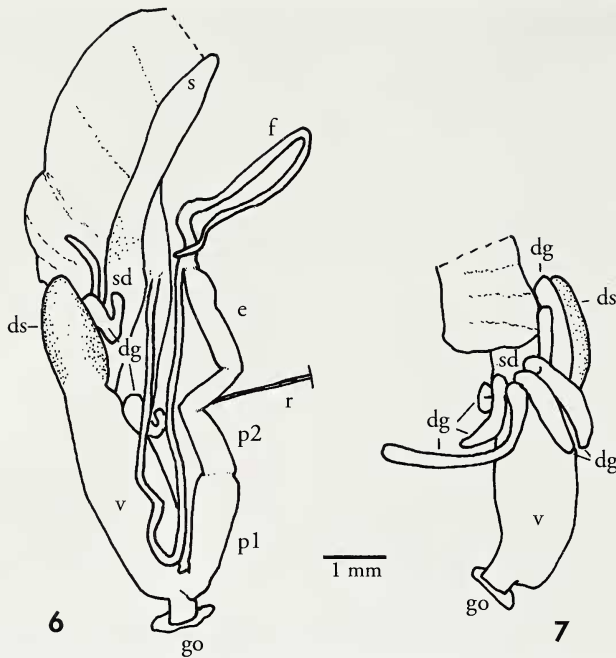
Figuras 1-5. Candidula coudensis spec. nov. holotipo, anchura de la concha 11,6 mm (BM nº 20100177). 1-3: concha adulta; 4, 5: holotipo fotografiado en vivo.

imal part of epiphallus; penis thin-walled, internally with conical verge (having small simple apical pore) descending from distal part of penis (p2) into proximal part of penis (p1). Free oviduct moderately long. Dart sac (stylophore) single, moderately large, muscular, united with wall of vagina for about three-quarters of its length, entering proximal part of vagina through conical papilla. Digitiform glands ("mucus glands") two, arising from vagina just distal to its union with dart-sac complex, each gland divided near base into two or three short branches. Spermatheca (bursa-copulatrix) cylindrical-conical, lying on spermooviduct; spermatheca duct rather short and wide.

Dimensions: holotype 11.6 × 5.0 mm, 90 adult paratypes 8.8-11.4 × 4.7-5.4 mm.

Distribution and habitat: *C. coudensis* has been found only in a range less than one kilometre in total extent, near Vale

da Couda, by the N348 road SE. of Almoester (district of Leiria), Portugal. This range overlaps the edges of three different 10-km squares of the U.T.M. grid (NE40, NE41 and NE51). *Candidula* cf. *belemensis* lives in the same areas, and also at several other sites within a 5 km radius on the same limestone hills where *C. coudensis* was not found. Within its restricted range *C. coudensis* occurs at ca 380-390 m altitude, over Mesozoic limestone that is exposed in crags facing east and north and also as scattered rocks and in stone walls. The largest numbers were found living on 12th December 2009, resting above the ground on herbs, grasses and low bushes on almost flat, rather open, disturbed ground near the roadside (11 living *C. coudensis* were found, with at least 11 living *C. cf. belemensis* in similar sites in the same small area). Single *C. coudensis* were also found living under



Figures 6, 7. *Candidula coudensis* spec. nov. Anatomy of genitalia of a paratype (in collection of G.A. Holyoak). 6: general view of anatomy of proximal genitalia; 7: view of vagina and dart sac from other side. Abbreviations, dg: digitiform gland(s); ds: dart sac; e: epiphallus; f: flagellum; go: genital orifice; p1: proximal part of penis; p2: distal part of penis; r: penial retractor muscle; s: spermatheca; sd: spermathecal duct; v: vagina.

Figuras 6, 7. Candidula coudensis spec. nov. Anatomía de genitales de un paratipo (en colección de G.A. Holyoak). Fig. 6 is Vista anatómica general de la parte proximal del tracto genital, Fig. 7 vista de la vagina y del saco del dardo desde el lado opuesto. Abreviaturas, dg: glándula(s) digitiforme(s); ds: saco del dardo; e: epifalo; f: flagelo; go: orificio genital; p1: parte proxima del pene; p2: parte distal del pene; r: músculo retractor del pene; s: espermateca; sd: conducto de la espermatecas; v: vagina.

limestone rocks near the sparsely vegetated base of the east-facing crags on 31st January 2008 and 10th June 2009.

Remarks: Among Iberian Helicellini the presence of only a single moderately large clearly visible dart sac is a distinctive feature of *Candidula*, although an externally unnoticeable "accessory sac" lacking a dart may also be present alongside it and sometimes also a trace of an atrophied dart sac within the opposite wall of the vagina (e.g. GITTENBERGER, 1985; HAUSDORF, 1988; ALONSO, IBÁÑEZ AND HENRIQUES, 1996; SCHILEYKO, 2006).

A review of Portuguese species of *Candidula* by GITTENBERGER (1993)

recognised six species, largely from shell characters. Of these, *C. intersecta* (Poirlet, 1801) and *C. gigaxii* (L. Pfeiffer, 1848) have wide ranges in western Europe, whereas the other four are apparently endemic to Portugal (*C. setubalensis* known only from Serra da Arrábida; *C. belemensis* known from districts of Faro (the Algarve) and Setúbal, and possibly (pers. obs.) northwards to the district of Leiria; *C. olisippensis* (Servain, 1880) known locally from the Algarve northwards to the district of Porto (formerly, Douro Litoral); *C. codia* (Bourguignat, 1859) known only from the Algarve, where additional localities were reported by MENDES SIMÕES, 2006).

C. coudensis differs from all of these except *C. setubalensis* in having a sharply keeled shell. However, the flagellum in *C. setubalensis* is much shorter (less than half length of epiphallus: GITTENBERGER, 1985) than in *C. coudensis* (in which it is longer than epiphallus: Fig. 6). Their shells also differ, comparisons based on 37 adult or nearly adult shells of *C. setubalensis* (in Collection of G.A. Holyoak) revealing that they are on average smaller (largest shell 9.7×4.6 mm), with even less convex whorls (so spire often lower, mouth more elliptical, peripheral keel even sharper), and umbilicus larger (averaging $ca\ 1/5$ of shell width) and exposing more of spire internally; the sculpture and coloration of the shell are similar. All of the five other species of *Candidula* accepted for Portugal by GITTENBERGER (1993) have depressed-globular shells with a rounded body whorl. In all five of these species the sculpture of radial ribs is weaker than in *C. coudensis*, although it is approached by *C. codia*, which otherwise differs markedly in its globular shell with domed spire.

Elsewhere, the genus *Candidula* has been reported over a wide range from Ireland eastwards to southernmost Sweden and southwards to Fuerteventura

(Canary Islands) in the west and the Balkan Peninsula in the east, with approximately 23 recognised species (KERNEY AND CAMERON, 1979; HAUSDORF, 1988, 1991; MANGANELLI AND GIUSTI, 1988; PUENTE, 1994; ALONSO, IBÁÑEZ AND HENRÍQUES, 1996). Except for *C. setubalensis*, as discussed above, no other species currently assigned to the genus has a sharply keeled shell. However, a relatively long penial flagellum, exceeding one-half of the length of the epiphallus, has been described for the Spanish endemic species *C. camporoblenensis* (De Fez, 1944) and *C. rocandioi* (Ortiz de Zárate, 1950) (APARICIO, 1982).

C. coudensis apparently reaches reproductive maturity in winter. A paratype with mature genitalia (Figs 6-7) was collected on 31st January 2008. Five of the snails collected on 12th December 2009 were kept alive indoors and these laid three clusters of eggs on 16th-18th January 2010. The clusters were of 36, 64 and 77 eggs respectively, laid in loosely-adherent rounded-conical heaps, with a few single eggs scattered elsewhere in the box. Individual eggs were spherical, 1.0-1.3 mm in diameter, more or less translucent, whitish, or sometimes with a slight yellow tinge.

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